

## CLAIMS

- 1 1. A catalyst system comprising:  
2 a complex with the formula:  
3  $[ML_Y(HSR)_{\bar{n}}]^n$   
4 wherein M is a transition metal cation;  
5 L is a ligand;  
6 Y is a whole number between 0 and 5;  
7  $\bar{n}$  is a whole number between 1 and 6;  
8 n is the charge of the complex;  
9 H is Hydrogen;  
10 S is sulphur; and  
11 R is any organic group or hydrogen.
- 1 2. The system of claim 1, wherein the transition metal is selected from the group  
2 consisting of cobalt, manganese, chromium and iron.
- 1 3. The system of claim 2, wherein M is selected from the group consisting of  $Co^{2+}$ ,  
2  $Mn^{2+}$ ,  $Fe^{2+}$ , and  $Cr^{3+}$ .
- 1 4. The system of claim 1, wherein the organic group is an alkyl or aryl group having  
2 between one to twenty carbon atoms.
- 1 5. The system of claim 4, wherein the alkyl or aryl group contains sulphur, nitrogen  
2 or oxygen atoms.

1 6. The catalyst of claim 1 wherein L is selected from the group consisting of cyano,  
2 amino, aquo, hydroxo, thiocyanato, trifluoroborato, phosphino, nitro, nitrate, and  
3 carboxo.

1 7. The catalyst of claim 1 wherein L is a chelating agent selected from the group  
2 consisting of dimethylglyoxime, phenanthroline, and ethylenediamine.

1 8. A method of preparing a polymer comprising:  
2 providing an organic compound to be polymerized;  
3 contacting the organic compound with a catalyst represented by the formula:



5 wherein M is a transition metal cation in a lower oxidation state;

6 L is a ligand;

7 Y is a whole number between 0 and 5;

8  $\bar{n}$  is a whole number between 1 and 6;

9 n is the charge of the complex;

10 H is Hydrogen;

11 S is sulphur; and

12 R is any organic group or hydrogen.

1 9. The method of claim 8, wherein M is selected from the group consisting of cobalt,  
2 manganese, chromium and iron.

- 1 10. The method of claim 8, wherein M is selected from the group consisting of  $\text{Co}^{2+}$ ,  
2  $\text{Mn}^{2+}$ ,  $\text{Fe}^{2+}$ , and  $\text{Cr}^{3+}$ .
- 1 11. The method of claim 8, wherein the organic group is an alkyl or aryl group having  
2 between one to twenty carbon atoms.
- 1 12. The method of claim 11, wherein the alkyl or aryl group contains sulphur, nitro-  
2 gen or oxygen atoms.
- 1 13. The method of claim 11, wherein the organic compounds are selected from the  
2 group consisting of olefins, conjugated dienes, vinyl compounds, allyl compounds and  
3 mixtures thereof.
- 1 14. The method of claim 8, wherein the organic compound is selected from the group  
2 consisting of styrene, methyl styrene, acrylonitrile, acrylic acid, methacrylic acid, ac-  
3 rylamide, methacrylamide, methyl methacrylate, ethyl methacrylate, maleic anhydride,  
4 maleic acid, fumaric acid, isoprene, butadiene, chloroprene, vinyl acetate, vinyl chlo-  
5 ride, vinylidene chloride, ethylene, propylene, butylene, isobutylene, alpha-olefins, allyl  
6 alcohol, alkyl vinyl ethers, and mixtures thereof.
- 1 15. The method of claim 8 wherein the organic compound to be polymerized is se-  
2 lected from the group consisting of unsaturated polyester resins, vinyl ester resins, alkyl  
3 resins, and glyptal resins.
- 1 16. The method of claim 8 wherein the method of preparing the polymer is selected  
2 from the group of techniques consisting of the system of mass, solution, suspension and  
3 emulsion.

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1 17. The method of claim 11, and further comprising preparing the catalyst including  
2 providing a transition metal containing compound selected from either the group  
3 of inorganic salts consisting of sulphates, nitrates, phosphates, and chlorides, or the group  
4 of organic compounds consisting of acetates, oxalates, hexanoates, octoates, oleates, de-  
5 canoates, palmitates, decanoates, naphthenates, and stearates; and  
6 contacting the transition metal containing compound with a thiol or mercaptan  
7 having less than 20 carbon atoms.

1 18. The method of claim 17 wherein the sulphur compounds and thiols or mercaptans  
2 are monofunctional and selected from the group consisting of hydrogen sulphide,  
3 methyl, ethyl, propyl, butyl, , hexyl, octyl, decyl, dodecyl, stearyl, benzyl, naphthyl, ben-  
4 zoyl, mercaptans and thiols, thioglycolic acid, and any mercaptan or thiol containing  
5 less than twenty carbons.

1 19. The method of claim 18 wherein the transition metal compound is a carboxylated  
2 transition metal selected from the group of salts consisting of cobalt, maganese, chro-  
3 mium, and iron salts, and the thiol or mercaptan includes a group selected from the group  
4 consisting butyl, hexyl, dodecyl, benzyl, benzoyl groups, hydrogen sulphide, thiohglyco-  
5 lic acid, and any alkyl or aryl group containing one to twenty carbons atoms.

1 20. The method of claim 8, and further comprising preparing the catalyst including  
2 providing a transition metal compound selected from the group of carboxylates  
3 consisting of cobalt carboxylates, manganese carboxylates, chromium carboxylates and  
4 iron carboxylates or from the group of inorganic salts consisting of sulphates, nitrates,  
5 phosphates, and chlorides;  
6 reacting an alkyl or aryl halide containing one to twenty carbon atoms with two  
7 equivalents of aqueous thiourea to from a hydrolyzed product; and  
8 reacting the product with the transition metal compound.

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- 1 21. The method of claim 8, wherein L is selected from the group consisting of cyano,  
2 amino, aquo, hydroxo, thiocyanato, trifluoroborato, nitro, nitrato, phosphino, and car-  
3 boxo.

- 1 22. The method of claim 8, wherein L is a chelating agent and selected from the group  
2 consisting of dimethylglyoxime, phenanthroline, and ethylenediamine.

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